sorted again in a secondary sorting channel **810**. As shown, the secondary sorting channel **810** repeats the sorting process of detecting and sorting based on a predetermined characteristic.

Given that each single channel sorting process produces some error (y) rate (y is a probability less than one of a particle being "selected" by mistake) of mistaken selections, the hierarchical architecture produces an lower error rate of y^2 for a 2-stage hierarchy as drawn or y^n for an n-stage hierarchy. For example, if the single channel error rate is 1% the 2-stage error rate is 0.01% or one part in 10^4.

Alternatively, the architecture could have M primary sets of N sorting channels per secondary channel. Given that the application wants to capture particles that have a presence in the input at rate z and single channel sorters have a maximum sorting rate x particles per second. The system throughput is M*N*x in particles per second. The number of particles aggregated in N channels per second is N*x*z and so N*z must be less than 1 so that all particles aggregated from N channels can be sorted by a single secondary channel. To increase throughput above N=1/z one must add parallel groups of N primary+1 secondary channels. Overall throughput then comes from M*N*x with M secondary channels.

FIG. **12** show a parallel-serial particle sorting system **160** according to another embodiment of the invention. The parallel-serial particle sorting system **160** includes a first parallel sorting module **161** and a second parallel sorting module **162**. The first sorting module **161** is applied in multiple marked particles and particles having both markers are sorted out and conveyed through the exit channel **165**.

FIG. **13** shows another parallel-serial particle sorting system **170**. The first parallel sorting module **171** separates particles having a first marker, collects the particles from the different channels and conveys the particles having the first marker through the first exit channel **175**. All other particles are then fed into a second parallel sorter **172** for sorting particles having a second marker. The particles having the second marker are collected and conveyed through a second exit channel **176**. Particles having neither the first marker nor the second marker are conveyed through a third exit channel **177**.

The present invention has been described relative to an illustrative embodiment. Since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are to cover all generic and specific features of the invention described herein, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described the invention, what is claimed as new and protected by Letters Patent is:

1. A microfluidic system for sorting particles, the microfluidic system comprising:

a first microfluidic flow channel formed in a particle processing component substrate having an upstream inlet configured to introduce a fluidic stream having a plurality of particles into the first microfluidic flow channel and downstream outlets configured to output portions of the fluidic stream of particles;

a detection region located downstream of the inlet, the detection region configured to allow a particle having a predetermined characteristic to be sensed, the sensed particle being one of the plurality of particles in the fluidic stream; and

a switching device located downstream of the detection region, the switching device operatively coupled to the first microfluidic flow channel to deliver a transient pressure pulse in a direction substantially perpendicular to a flow direction of the fluidic stream of particles,

wherein the transient pressure pulse displaces and separates a selected single sensed particle from the fluidic stream of particles,

wherein the selected particle is displaced and separated from the fluidic stream of particles in a switching region,

wherein the fluidic stream of unselected particles flows into a first downstream outlet configured to output a first portion of the fluidic stream of particles,

wherein the selected particle flows into a second downstream outlet configured to output a second portion of the fluidic stream of particles,

wherein the transient pressure pulse is not generated downstream of the switching region,

wherein the switching device, when activated, does not block or partially block flow of the fluidic stream of particles, and

wherein the particle processing component substrate includes a reservoir adapted for dampening or absorbing the transient pressure pulse propagated across the microfluidic channel.

2. The microfluidic system of claim **1**,

wherein the switching device is integrally provided on the particle processing component substrate, and

wherein the switching device is configured to be activated by a first external actuator.

3. The system of claim **2**, further comprising a second actuator, external to and operatively associated with the first microfluidic flow channel, for processing the sample on a particle-by-particle basis.

4. The system of claim **3**, wherein the first external actuator is adapted for directing particles into a first of the one or more downstream outlets and the second external actuator is adapted for directing particles into a second of the one or more downstream outlets.

5. The system of claim **1**, wherein the particle processing component substrate includes a reservoir operatively associated with the switching device and adapted for originating the transient pressure pulse.

6. The microfluidic system of claim **1**, wherein

the switching device introduces liquid into the microfluidic flow channel such that the transient pressure pulse is a transient hydraulic pressure pulse.

7. The system of claim **1**, wherein the switching device further includes first and second side channels in fluid communication with the first microfluidic flow channel, the second side channel positioned opposite to the first side channel.

8. The system of claim **1**, further including an actuator for activating the switching device and wherein the actuator is a piezoelectric actuator.

9. The system of claim **1**, further including an actuator for activating the switching device and wherein the actuator is an electromagnetic actuator.

10. The system of claim **1**, further including an actuator for activating the switching device and wherein the actuator is a thermopneumatic actuator.